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**A New Species of the *Copidognathus pulcher* Group  
(Acari: Halacaridae) from Western Australia:  
Description of Adults and Juveniles and  
Notes on Developmental Pattern**

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Adults and juveniles of *Copidognathus vulgaris* sp. nov. are described. This mite, very common in the upper phytal zone of Rottnest Island, Western Australia, belongs to the *pulcher* group, a natural species group spread world-wide. External morphological characters of adults, protonymphs, and larvae during ontogenetic development are outlined and discussed.

**Key Words:** marine mite, *Copidognathus*, new species, description, postembryonic development, Australia

**Introduction**

About one third of the halacarid species present around Rottnest Island, Western Australia, belong to the genus *Copidognathus*. One of the most common species of *Copidognathus* found amongst small bunches of intertidal algae is *C. vulgaris* sp. nov., a species that belongs to the cosmopolitan *pulcher* group. Beside the adults, the samples contained protonymphs and larvae. All instars are described. The developmental pattern of the external characters of *C. vulgaris*, as well as those of other congeneric species, is outlined.

**Material and Methods**

During a stay on Rottnest Island, Western Australia, in April of 1991, halacarid mites were extracted from a variety of intertidal and subtidal substrata by freshwater washings. The mites were cleared in lactic acid and mounted in glycerine jelly. Drawings were prepared using a camera lucida. The holotype and paratypes are deposited in the Western Australian Museum, Perth (WAM), other material in the Zoological Collection of the Graduate School of Science, Hokkaido University, Sapporo (ZIHU), the Senckenberg Museum Frankfurt (SMF), and the author's halacarid collection.

Abbreviations used in the descriptions: AD, anterior dorsal plate; AE, anterior epimeral plate; AE-1 to AE-3, anterior to posterior setae on AE; d, dorsal setae on idiosoma, d-1 to d-6, first to sixth pair of dorsal setae; GA, genitoanal plate; GO, genital opening; GP, genital plate; OC, ocular plate(s); P, palp, P-2 to P-4, second to fourth palpal segment; pas, parambulacral seta(e); PD, posterior dorsal plate; PE,

posterior epimeral plate(s); PE-d, dorsal seta on PE; PE-1 to PE-3, ventral setae on PE; pgs, perigenital setae. Legs numbered I to IV, leg segments 1 to 6; e.g., I-6, tarsus on leg I.

***Copidognathus vulgaris* sp. nov.**  
(Figs 1A-G, 2A-K, 3A-I, 4A-F)

**Material examined.** *Holotype.* female (WAM), Western Australia, Rottnest Island, Nancy Cove, green algae from rocky platform, shallow water, 20 January 1991, I. Bartsch coll.

*Paratypes.* Female, male, two protonymphs, and larva (WAM). Female, male, and protonymph (ZIHU). Female, male, and protonymph (SMF). Five males, five females, five protonymphs, three larvae (author's collection).

**Description.** *Female.* Idiosoma 312-372  $\mu\text{m}$  long, holotype 312  $\mu\text{m}$  long, 185  $\mu\text{m}$  wide. Dorsal plates with porose panels with canaliculi; remainder of plates reticulate (Fig. 1A, B). Membraneous integument between plates with numerous parallel striae. AD 102  $\mu\text{m}$  long, 90  $\mu\text{m}$  wide, with small frontal protuberance. Porose panels fused into an inverted Y; anterior leg of 'Y' two to four panels wide, each panel enclosing 7-13 canaliculi; posterior legs of 'Y' 15  $\mu\text{m}$  or two (rarely three) porose panels wide. Gland pores within anteromarginal edges of AD. OC 1.9 times longer than wide, 65  $\mu\text{m}$  long, 35  $\mu\text{m}$  wide, with faint spots of eye pigment. Posterior cornea not divided. Porose areola medial to corneae enclosing three to four panels with canaliculi. Gland pore and adjacent pore canaliculus in lateral margin of plate. PD 190  $\mu\text{m}$  long, 112  $\mu\text{m}$  wide, in young females extending anteriorly distinctly beyond level of posterior angles of OC (Fig. 1B), in ovigerous females (Fig. 1E) only slightly beyond this level. Pair of costae 15  $\mu\text{m}$  or two porose panels wide. Single pair of gland pores in posterior portion of PD. Dorsal idiosomal setae 7  $\mu\text{m}$  long; d-1 close together in middle of AD; d-2 within membraneous integument between AD and OC; d-3 either within margin of PD or within striated integument immediately anterior to PD; d-4 and d-5 on PD, d-4 at level of insertion of leg III, d-5 slightly posterior to leg IV and well anterior to pair of gland pores.

AE 110  $\mu\text{m}$  long, 177  $\mu\text{m}$  wide; distinctly panelled (Fig. 1C) and pierced by numerous canaliculi (Fig. 1D). In ovigerous females, areas with striated integument (Fig. 1F) larger than in recently hatched ones. Posterior margin of AE excavated. Epimeral processes I and II present though short. Epimeral pores 5  $\mu\text{m}$  in diameter. Three pairs of ventral setae 30-45  $\mu\text{m}$  long. Integument of PE and GA pierced by canaliculi. PE extending anteriorly to level of corneae on OC; posteriorly only 24  $\mu\text{m}$  beyond insertion of leg IV. Dorso- and ventrolateral setae on PE 50-55  $\mu\text{m}$  long, the other ventral setae 20-30  $\mu\text{m}$  long. GA 135  $\mu\text{m}$  long, 101  $\mu\text{m}$  wide; GO 75  $\mu\text{m}$  long, 48  $\mu\text{m}$  wide; distance between anterior margin of GO and GA less than half of length of GO. Anterior pair of pgs within anterior margin of GA, middle pair of setae slightly posterior to level of anterior margin of GO. Ovipositor surpassing GO by 17  $\mu\text{m}$ , that is 1/4 of length of GO; ovipositor not reaching level of anterior pair of pgs. Genital sclerites with pair of subgenital setae.

Gnathosoma 103  $\mu\text{m}$  long, 72  $\mu\text{m}$  wide, 1.4 times longer than wide (Fig. 1G). Integument of ventral and lateral flanks with numerous canaliculi; dorsal flank reticulate. Tectum truncate. Rostrum 42  $\mu\text{m}$  long, 32  $\mu\text{m}$  wide, not reaching end of

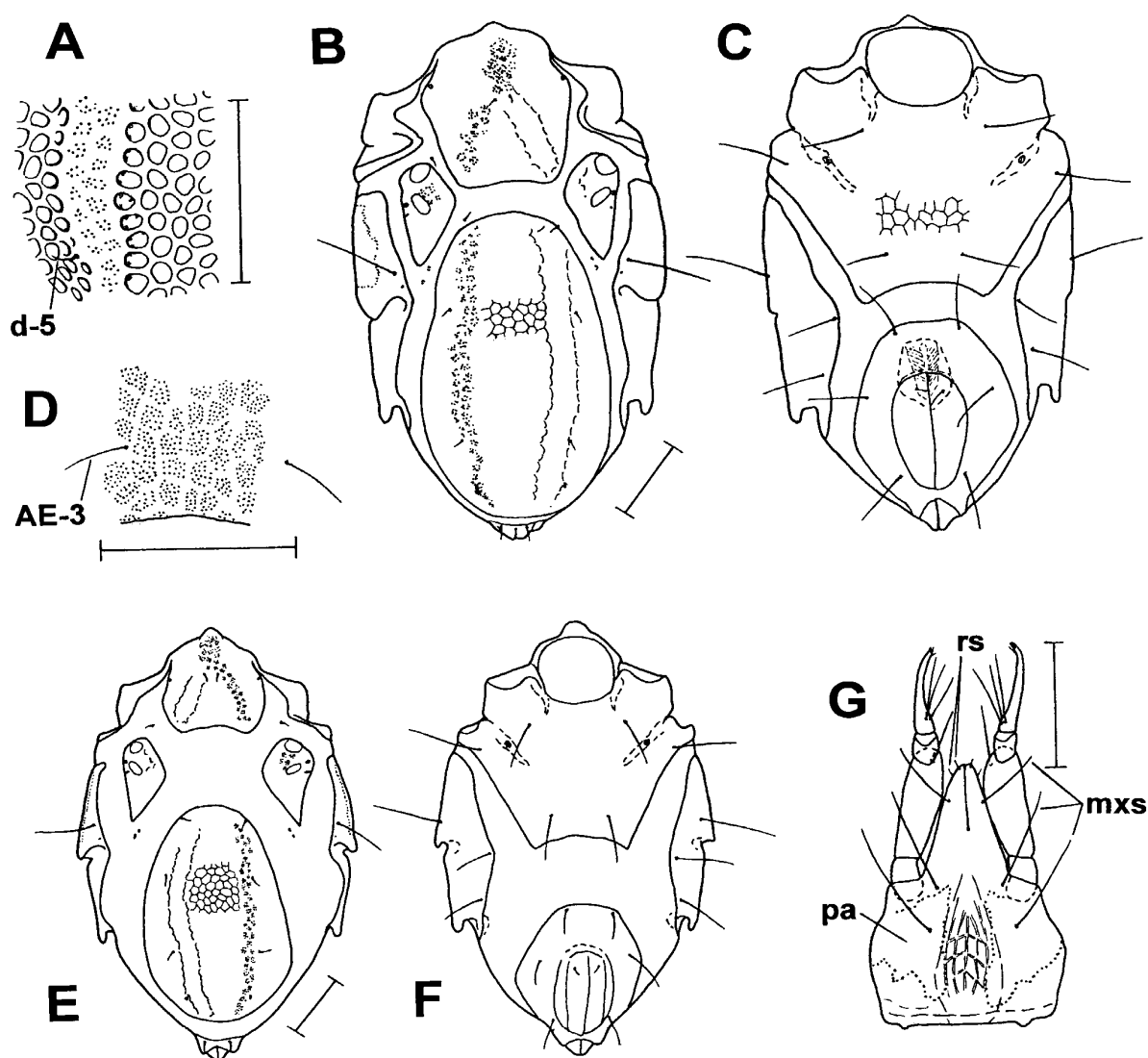


Fig. 1 *Copidognathus vulgaris* sp. nov., female. A, portion of PD level with d-5; B, idiosoma, dorsal; C, idiosoma, ventral; D, posterior portion of AE; E, ovigerous female, dorsal; F, ovigerous female, ventral; G, gnathosoma, ventral. (AE-3, third seta on AE; d-5, fifth dorsal idiosomal seta; mxs, maxillary setae; pa, porose areola; rs, rostral setae) Scales = 50  $\mu$ m.

P-3. Rostrum somewhat shorter than gnathosomal base. Gnathosoma with two pairs of maxillary setae on gnathosomal base and one pair in distal third of rostrum; two pairs of rostral setae near tip of rostrum. P-4 shorter than P-2. Seta on P-2 wider than setae on P-4.

Legs shorter than idiosoma. Leg I longer than leg II and about as long as leg IV. Telfemora I and II almost as long as tibiae (Fig. 2 A, B); telfemora III and IV 0.8-0.9 times shorter than tibiae (Fig. 2 C, D). Telfemora I and II each with porose ventral areola with numerous canaliculi. Telfemora I to IV 1.6, 1.5, 1.8, and 1.7 times longer than high respectively. Distodorsal portions of trochanters III and IV slightly bulbous. All tarsi with membranes of claw fossa. Leg chaetotaxy, from trochanter to

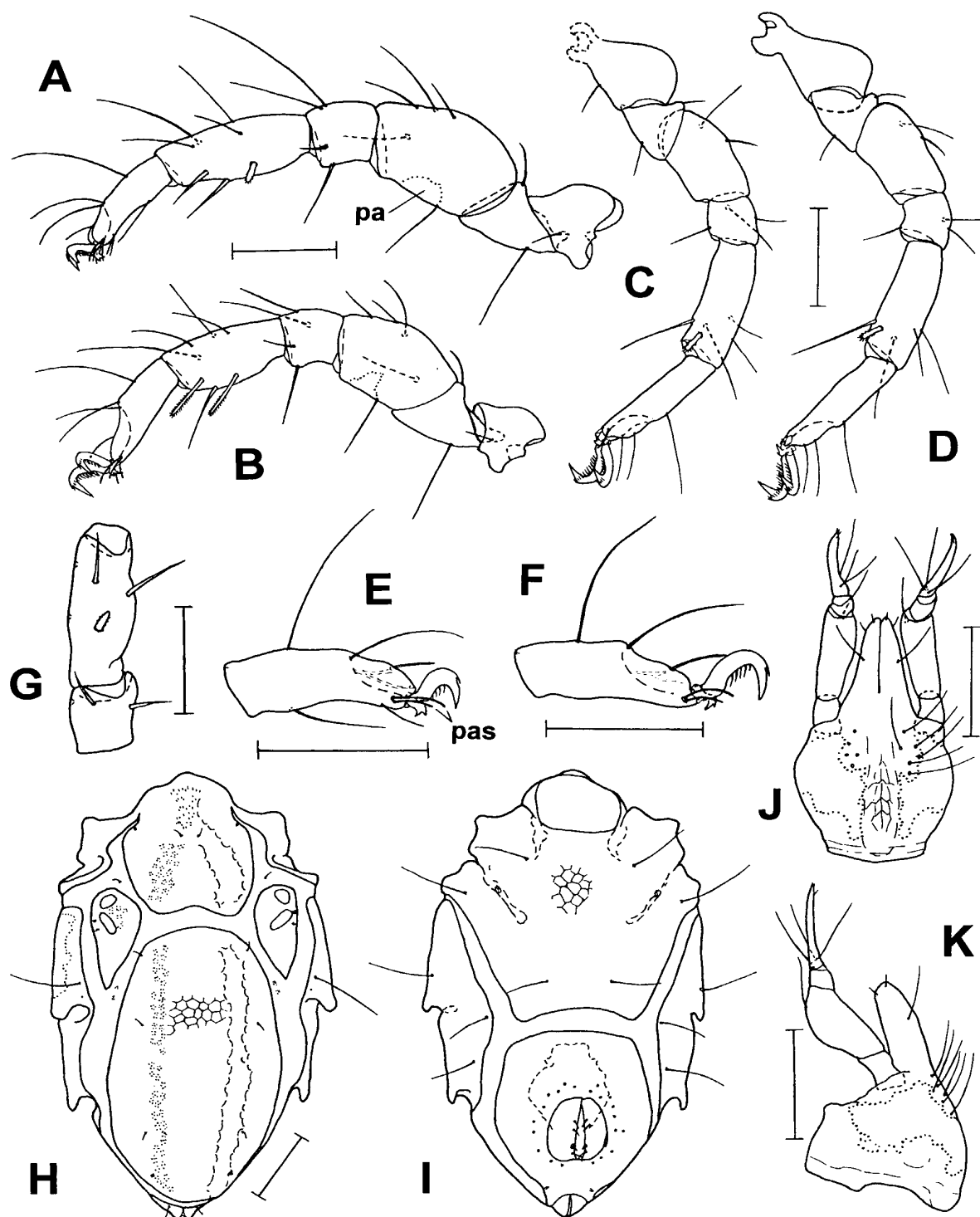


Fig. 2 *Copidognathus vulgaris* sp. nov. A, leg I, medial, female; B, leg II, medial, female; C, leg III, medial (stippled portion of trochanter in holotype broken), female; D, leg IV, medial, female; E, tarsus I, lateral (medial setae and claw omitted), female; F, tarsus II, lateral (medial setae and claw omitted), female; G, genu and tibia I, ventral, male; H, idiosoma, dorsal, male; I, idiosoma, ventral, male; J, gnathosoma, ventral, male; K, gnathosoma, lateral, male. (pa, porose areola; pas, parambulacral setae) Scales = 50  $\mu$ m.

tarsus (solenidion included, pas excluded): leg I - 1, 2, 5, 4, 7, 7; leg II - 1, 2, 5, 4, 7, 4; leg III - 1, 2, 2, 3, 5, 3; leg IV - 0, 2, 2, 3, 5, 3. Tibia I ventrally with one spur-like, bipectinate seta and two smooth, tapering setae. Tibia II with tapering ventral seta and two bipectinate ventromedial setae. Tibiae III and IV each with wide, bipectinate ventromedial seta and smooth, tapering ventral seta. Tarsus I with long ventral seta inserted at level of basalmost dorsal setae; pair of fossary setae inserted adjacent to each other within dorsal edge of claw fossa. Solenidion  $12\ \mu\text{m}$  long, with minute narrow tip; famulus reduced; afferent canal of both solenidion and famulus within lateral membrane of claw fossa (Fig. 2E). Tip of tarsus I with pair of eupathidia and doubled pas. Tip of tarsus II with pair of doubled pas; arrangement of dorsal setae same as on tarsus I; solenidion  $16\ \mu\text{m}$  long (Fig. 2F). Tarsi III and IV with basalmost dorsal seta near claw fossa, and following pair of setae on membranes of claw fossae. Tip of tarsus III with medial eupathid and lateral spine-like pas. Both pas of tarsus IV spine-like and delicately bipectinate.

Claws on tarsus I shorter than on succeeding tarsi. All claws with J-shaped pecten. Claw pecten on tarsi II to IV extending to bases of claws. All tarsi with bidentate median claw.

*Male.* Idiosoma  $313\text{--}326\ \mu\text{m}$  long. A paratype,  $313\ \mu\text{m}$  long, with  $97\ \mu\text{m}$  long and  $87\ \mu\text{m}$  wide AD; ornamentation of plate as in female (Fig. 2H). OC  $72\ \mu\text{m}$  long,  $36\ \mu\text{m}$  wide, 2.0 times longer than wide. PD  $194\ \mu\text{m}$  long,  $117\ \mu\text{m}$  wide; PD extending beyond d-3.

AE  $122\ \mu\text{m}$  long,  $170\ \mu\text{m}$  wide. Epimeral pores constricted by numerous minute teeth. GA  $133\ \mu\text{m}$  long,  $106\ \mu\text{m}$  wide. GO  $44\ \mu\text{m}$  long,  $40\ \mu\text{m}$  wide. Distance from anterior margin of GO to GA slightly more than length of GO (Fig. 2I). Eight to eleven pgs on either side, in all 19-22 setae standing closely around GO. Genital sclerites with four pairs of short subgenital setae, three pairs being slender, one pair spur-like.

Gnathosoma  $108\ \mu\text{m}$  long,  $71\ \mu\text{m}$  wide. One pair of maxillary setae on rostrum, and five to six pairs (maximum seven pairs) of setae on gnathosomal base (Fig. 2J, K).

Legs as in female. Tibia I with one spur-like, pectinate seta, and two smooth, tapering ventral setae (Fig. 2G).

*Protonymph.* Idiosoma  $272\text{--}345\ \mu\text{m}$  long. Dorsal plates smaller than in adults (Fig. 3A). Porose areolae on AD a single porose panel wide; outline of areolae as in adults. OC short, posterior margin rounded. Medial to corneae an areola with canaliculi. PD much smaller than in adults; d-3 inserted within striated integument. Major parts of costae on PD one porose panel wide. Area outside distinctly raised costae slightly reticulated, each mesh with three to five delicate pits (Fig. 3C).

Ventral plates coarsely porose. Outline of AE and PE (Fig. 3B) similar to that of these plates in adults. AE with three pairs of setae; PE with one dorsal seta and two ventral setae. GP small, separated from anal plate, and lacking setae.

Outline of gnathosoma as in adults. Gnathosoma with two pairs of maxillary setae, one on rostrum and one on gnathosomal base (Fig. 3D). Chaetotaxy of palps as in adults.

Outline of legs (Fig. 3F-I) same as in adults. Leg IV five-segmented. Telofemur I with small ventrolateral areola with scattered canaliculi; other telofemora lacking distinct porose areolae. Chaetotaxy from trochanter to tarsus (parambulacral setae excluded, solenidion included): leg I - 1, 2, 3, 4, 5, 7; leg II - 1, 2, 3, 4, 5, 4; leg III - 1, 1,

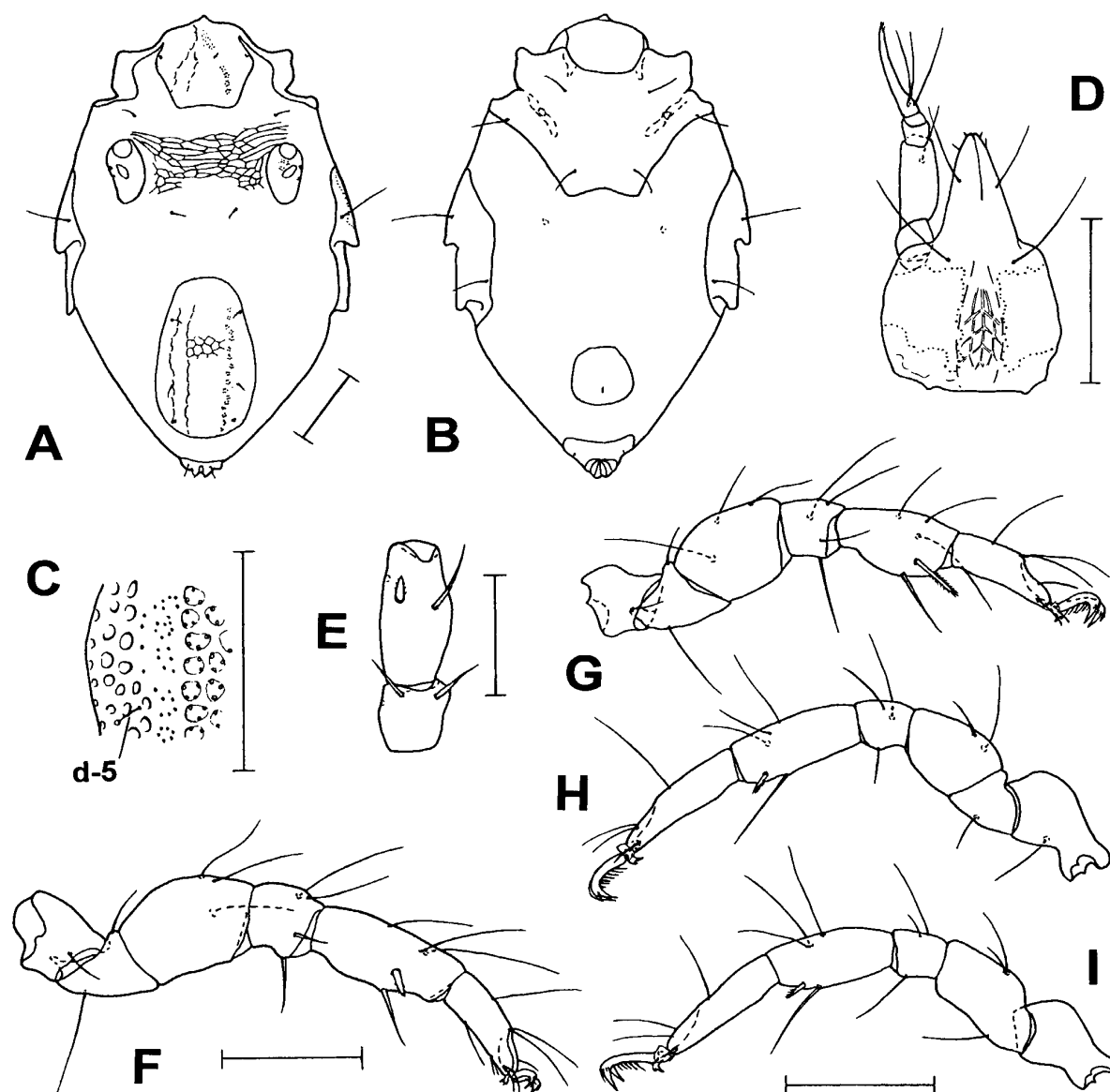


Fig. 3 *Copidognathus vulgaris* sp. nov., protonymph. A, idiosoma, dorsal; B, idiosoma, ventral; C, portion of PD level with d-5; D, gnathosoma, ventral; E, genu and tibia I, ventral; F, leg I, medial; G, leg II, medial; H, leg III, medial; I, leg IV, medial. (d-5, fifth dorsal idiosomal seta) Scales = 50  $\mu$ m.

2, 3, 5, 3; leg IV - 0, 3, 3, 5, 3. Tibia I with bipectinate ventromedial seta and tapering, smooth ventral seta (Fig. 3E). Tarsus I with pair of doubled pas, tarsus II with singlets; tarsus III with seta-like medial and spur-like lateral pas; both pas on tarsus IV spur-like.

*Larva.* Idiosoma 170-223  $\mu$ m long. Dorsal plates smaller than in protonymphs (Fig. 4A) and sculptured with small pits; plates lacking porose areolae. OC with two corneae, a gland pore, and a pore canaliculus; plate only slightly extending beyond pore canaliculus. PD with 5  $\mu$ m wide costae, these costae lacking canaliculi.

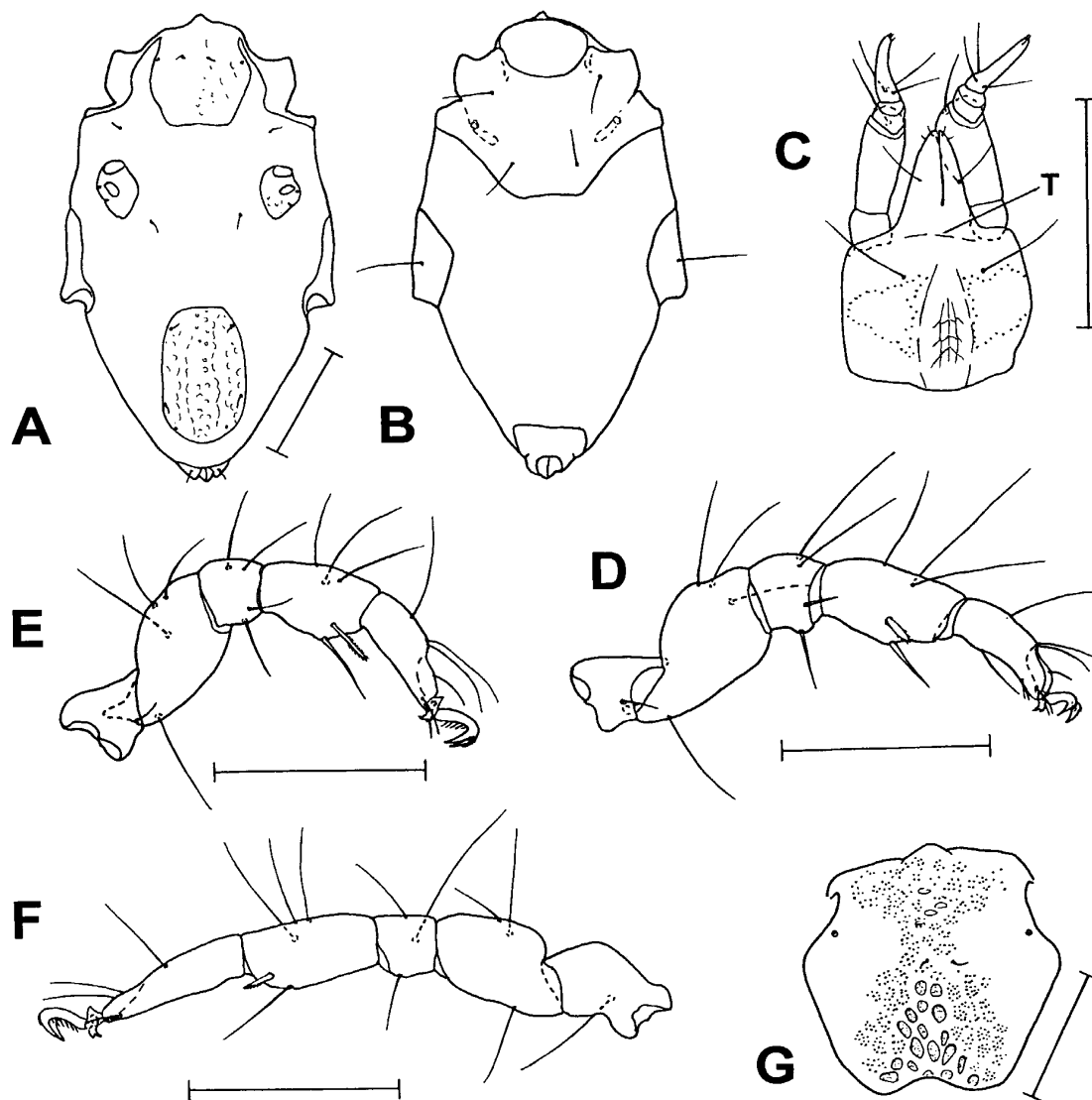


Fig. 4A-F. *Copidognathus vulgaris* sp. nov., larva. A, idiosoma, dorsal; B, idiosoma, ventral; C, gnathosoma, ventral; D, leg I, medial; E, leg II, medial; F, leg III, medial. (T, tectum). Fig. 4G. *Copidognathus ficipacus* Bartsch, anterior dorsal plate, female. Scales = 50  $\mu$ m.

Remainder of plate with small, 2-3  $\mu$ m wide pits but without reticulation. Setae d-4 near anterior margin of PD. AE and PE uniformly porose. AE with two pairs of setae; PE with single pair of setae (Fig. 4B). No genital plate present.

Outline of gnathosoma similar to that of protonymphs and adults. Tectum truncate (Fig. 4C). Chaetotaxy of palps as in adults.

Three pairs of legs five-segmented (Fig. 4D-F). Leg chaetotaxy (parambulacral setae excluded, solenidion included): leg I - 1, 4, 4, 5, 7; leg II - 1, 4, 4, 5, 4; leg III - 1, 3, 3, 5, 3. Number and outline of parambulacral setae same as in protonymphs. Femora lack porose areolae.

**Remarks.** *Copidognathus vulgaris* is most similar to *C. neotrichius* Newell, 1984, and *C. ficipacus* Bartsch, 1992. Both species are known from the southwestern Pacific,

*C. neotrichius* from off Chile and *C. ficipacus* from the Society Islands (Newell 1984; Bartsch 1992b). Males of these three species have an increased number of maxillary setae. The porose areola in the anterior portion of the AD of *C. ficipacus* (Fig. 4G) is distinctly larger than in *C. vulgaris*, and the d-1 insert further posterior to the first pair of gland pores (distance to level of these gland pores about  $10\text{ }\mu\text{m}$ ). In females of *C. ficipacus*, the ovipositor almost extends to the anterior margin of GA (distance between ovipositor and GA  $5\text{ }\mu\text{m}$ ), whereas in *C. vulgaris* the ovipositor extends to about halfway between the anterior margin of GO and GA, and is removed from the anterior margin of GA by  $30\text{ }\mu\text{m}$ . The idiosomal length of *C. neotrichius* is 260-290  $\mu\text{m}$ . This species is smaller, and the porose areolae on AD and PD are wider, than in *C. vulgaris*.

*Copidognathus vulgaris* is a member of the *pulcher* group (Bartsch 1984) which equals Newell's *Copidognathus* key group 7500 (Newell 1984). This natural species group includes a dozen species and is known from all oceans. The characters of the group are: AD with anterior porose areola and pair of generally oblong posterior porose areolae. Areolae often fused and forming inverted Y. Gland pores near margin of AD. OC triangular, posteriorly never extended like a tail. PD generally with two, rarely with four costae. In the majority of species, porose areolae with canaliculi, the latter arranged within panels. Single pair of gland pores in posterior portion of PD. Setae d-1 to d-6 small in contrast to long marginal and ventral setae. Setae d-1 placed close together, d-2 in striated integument between AD and OC. Ventral plates evenly porose. Males with perigenital setae in ring close around GO. Gnathosoma often with three pairs of maxillary setae; in males, number of setae on gnathosomal base may be higher. Legs shorter than idiosoma. Tarsi I to IV with membranes of claw fossa. Ventral flank of telofemora I and II generally with triangular, porose areola. Leg chaetotaxy, from trochanter to tarsus (solenidion included, pas excluded): leg I - 1, 2, 5, 4, 7, 7; leg II - 1, 2, 5, 4, 7, 4; leg III - 1, 2, 2, 3, 5, 3; leg IV - 0, 2, 2, 3, 5, 3. Basalmost of three ventral setae on tibia I short, spine-like, and often coarsely pectinated. Bipectinate seta on tibiae III and IV conspicuously short but wide. Tarsi I to IV each with three dorsal setae. Tarsi I and II each with two distal fossary setae inserted at proximal end of claw fossa. Claws on tarsus I shorter than on succeeding tarsi. Tarsus IV with pair of spur-like parambulacral setae.

### Postembryonic Development of External Characters in *Copidognathus vulgaris*

**Idiosoma.** *Size of dorsal plates.* Relative to the length of the idiosoma, the changes in size and outline of the AD are small. The OC of larvae and protonymphs are short and ovate, 1.4 (larva) and 1.7 (protonymph) times longer than wide; the OC of adults are 1.9-2.0 times longer than wide. Compared with the larva, the PD of the protonymph is only slightly enlarged whereas the PD of adults is distinctly longer and wider; the plate extends to or beyond the d-3, and the d-4 and d-5 are no longer within the lateral margins of the plate.

*Dorsal idiosomal setae.* Number and arrangement are the same in all stages.

*Gland pores.* Number and arrangement are the same in all instars.

*Ornamentation of the dorsal plates.* The larvae lack the porose panels present in adults. Protonymphs have porose panels but they are smaller than those of adults.

*Ventral plates.* The outline of the AE is, apart from the size, similar in the



juveniles and adults. The pair of PE of the larvae are short, and they include only the epimera of the third pair of legs. The PE of the protonymphs also includes the epimeron of leg IV. The PE of the adults is larger than in the protonymphs and passes further beyond the insertion of legs IV. The larva lacks a genital plate. The protonymphs have a small genital plate with a faint primordial genital slit. In adults the genital plate is greatly enlarged and fused with the anal plate, and its posterior portion is provided with a large genital opening and a pair of genital sclerites.

**Ventral setae.** The AE of the larvae bears two pairs of ventral setae (AE-1 and AE-3), while that of protonymphs and adults bears three pairs of setae. The PE of the larvae has one seta (PE-1), that of the protonymphs one dorsal and two ventral setae, and the PE of adults one dorsal and three ventral setae. The protonymphal genital plate lacks setae; the females have three pairs of perigenital setae and a pair of subgenital setae; the males of *C. vulgaris* bear 8-11 pairs of perigenital setae and four pairs of subgenital setae.

**Ornamentation of ventral plate.** The plates are coarsely punctate. A similar punctation is present in all instars.

**Gnathosoma.** The gnathosoma of the protonymphs resembles that of the larvae. In the females an additional pair of maxillary setae appears on the gnathosomal base, in the males four to six pairs of such setae. The gnathosomal base of the protonymphs and adults is more heavily ornamented than in the larvae.

**Legs.** The larvae have the three pairs I, II, and III. In protonymphs the fourth pair is added.

**Number of segments.** The legs of the larvae have the segments trochanter, femur, genu, tibia, and tarsus. In the protonymphs, legs I to III are six-segmented and leg IV is five-segmented. In the adults, all four pairs of legs are six-segmented.

**Number of setae.** The number of setae on the trochanters is the same throughout postembryonic development.

The femora of the larvae each have a single ventral seta in the basifemur portion, and 3, 3, 2 dorsal setae in the portion representing telofemora I - III. The protonymphal femur IV resembles the larval femur III; it is still undivided and bears one ventral and two dorsal setae. The protonymphal basifemora I and II each bear two setae. The number of setae on telofemora I - III corresponds to that of the larva. In the adults, the basifemora I - IV each have two setae and telofemora I - IV have 5, 5, 2, 2 setae, respectively.

The number of setae on the genua is unaltered.

The tibiae of the larvae, as well as those of the protonymphs, each have two ventral and three dorsal setae. In the adults a ventromedial seta and a dorsal seta are added to each tibia I and II. The number of setae on tibiae III and IV in the adults is the same as in the protonymphs.

The arrangement and number of setae on tarsi I - IV of the adults are mainly the same as in the larvae and protonymphs, the only difference being found in the parambulacral setae; tarsi I and II of the larvae each have a pair of singlets, but the tarsi of adults bear doublets.

### Developmental Pattern in *Copidognathus*

Species of *Copidognathus* go through one larval and one nymphal instar before

the final moult to the adults. Larvae are characterized by three pairs of legs. In the following instar, the protonymph, another segment with the fourth pair of legs is inserted posterior to leg III.

The idiosoma of *Copidognathus* is covered with the dorsal plates AD, a pair of OC, and PD. These plates are present in all instars (Fig. 5A-C), although size, outline, and ornamentation may change considerably. Growth of the AD is mainly within the posterior portion, that of the OC in the portion posterior to the corneae, gland pore, and pore canaliculus. In adults, the posterior part of the OC may be very elongate, even tail-like, as, for example, in representatives of the *oculatus* group (sensu Bartsch 1993) and many species of the *gibbus* group (sensu Bartsch 1994). Change in size and outline is most marked in the PD; especially its middle and anterior portions become extended in length and width. Many adult *Copidognathus* have an anteriorly truncate PD which almost meets the AD; in some species, the dorsal plates are fused (e.g., in *Copidognathus canaliculifer* Bartsch, 1994, *C. scutellus* Bartsch, 1985, and *C. uniscutatus* Bartsch, 1984), whereas in the protonymphs, as in the larvae, the PD is more or less ovate. In the juvenile (growing) stages, the areas with membraneous, expandable integument are large. The plates of the larvae are thinner than those of the adults, and the ornamentation is generally weak; porose areolae, if present, are small. During the next instars, the degree of sclerotization and ornamentation increases.

The ventral plates AE, the pair of PE, and the anal plate are present in all developmental stages (Fig. 5D-F). In the juveniles, the plates are separated by membraneous integument; in adults, they are enlarged and may be contiguous or fused. The AE-2, absent in larvae, are added to the protonymphal AE. In contrast to the AE, the PE are considerably enlarged during development; the epimera IV are added in the protonymph, and in species with a prolonged, tail-like PE, this character is expressed only in the adults. Demarcated porose areolae, present in the adults of many species, are often absent in the larvae but occur in the protonymphs and reach their final size in the adults. The pair of larval PE bears a single pair of setae, the PE-1. In the protonymph, the PE-d and PE-3 are added, and in the adults, the pair of PE-2. The genital plate, first appearing in the protonymphs, is in the adults considerably enlarged, fused with the anal plate, and provided with perigenital and subgenital setae.

In the majority of species, the outline and the chaetotaxy of the gnathosoma is the same throughout all instars. One exception is the *pulcher* group, where in the adults the number of maxillary setae on the gnathosomal base is increased. In several adult species of *Copidognathus*, the rostrum is slender and much longer than the gnathosomal base; in the juveniles of these species, the relative length to width of the gnathosoma, and length of rostrum to that of gnathosomal base, is smaller. A huge, crest-like tectum, characteristic of many species of the *gibbus* group, is present only in the adults; juveniles have only a short tectal projection.

Relative to the idiosoma, the length of the legs and their segments is rather similar in all instars. The most evident difference between larvae (Fig. 6A, D, G) and protonymphs (Fig. 6B, E, H, J) is the insertion of the fourth pair of legs posterior to legs III and the subdivision of the femora I to III, moreover, a dorsal seta occurs on each basifemora I and II. The adults differ from protonymphs in that the femur of leg IV is subdivided (Fig. 6K); to the basifemora III and IV each a dorsal seta is added (Fig. 6I, K), to the telofemora I and II generally a basidorsal and ventral seta, and to

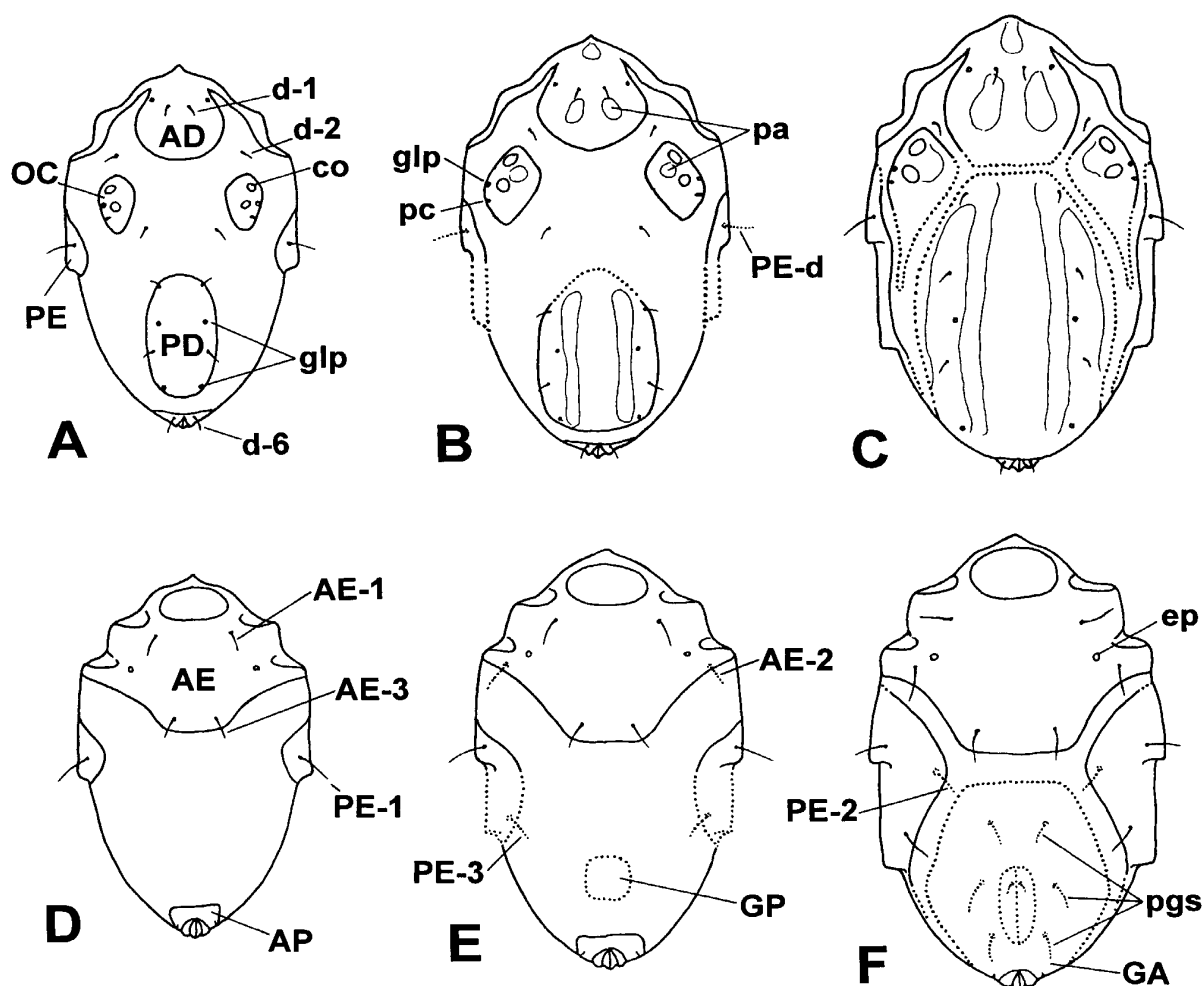


Fig. 5. Generalized idiosoma of *Copidognathus*. A, dorsum, larva; B, dorsum, protonymph; C, dorsum, adult; D, venter, larva; E, venter, protonymph; F, venter, female. (dotted lines indicate plates or setae that are either new or have markedly grown in size in this instar) (AD, anterior dorsal plate; AE, anterior epimeral plate; AE-1 to AE-3, anterior to posterior setae on AE; AP, anal plate; co, cornea; d-1, d-2, d-6, first, second, and sixth pair of dorsal setae; ep, epimeral pore; GA, genitoanal plate; glp, gland pore; GP, genital plate; OC, ocular plate; pa, porose areola; pc, pore canaliculus; PD, posterior dorsal plate; pgs, perigenital setae; PE, posterior epimeral plate; PE-d, dorsal seta on PE; PE-1 to PE-3, ventral setae on PE)

the tibiae I and II a bipectinate ventral and slender dorsal seta (Fig. 6C, F). The main zone of growth is in the proximal half of the tibiae and hence, it is likely that the proximal one of the two ventromedial setae is the new one in the adults. However, in species of the *pulcher* group, the ventromedial seta on the larval and protonymphal tibia I (Figs 4D, 3E, F) equals in outline the basal one of the ventromedial setae of the adults (Fig. 2A, G). Judging from the outline of this seta, it has in adults moved to a more proximal position and it is the apical seta that has been added. The outline of the telofemora, as well as of the genua and tibiae, may change considerably due to a development of lamellae. On the telofemora, the adults of the *gibbus* group have large lamellae; others, e.g., *C. acanthoscelus* Bartsch, 1992a, have spiniform ventral lamellae,

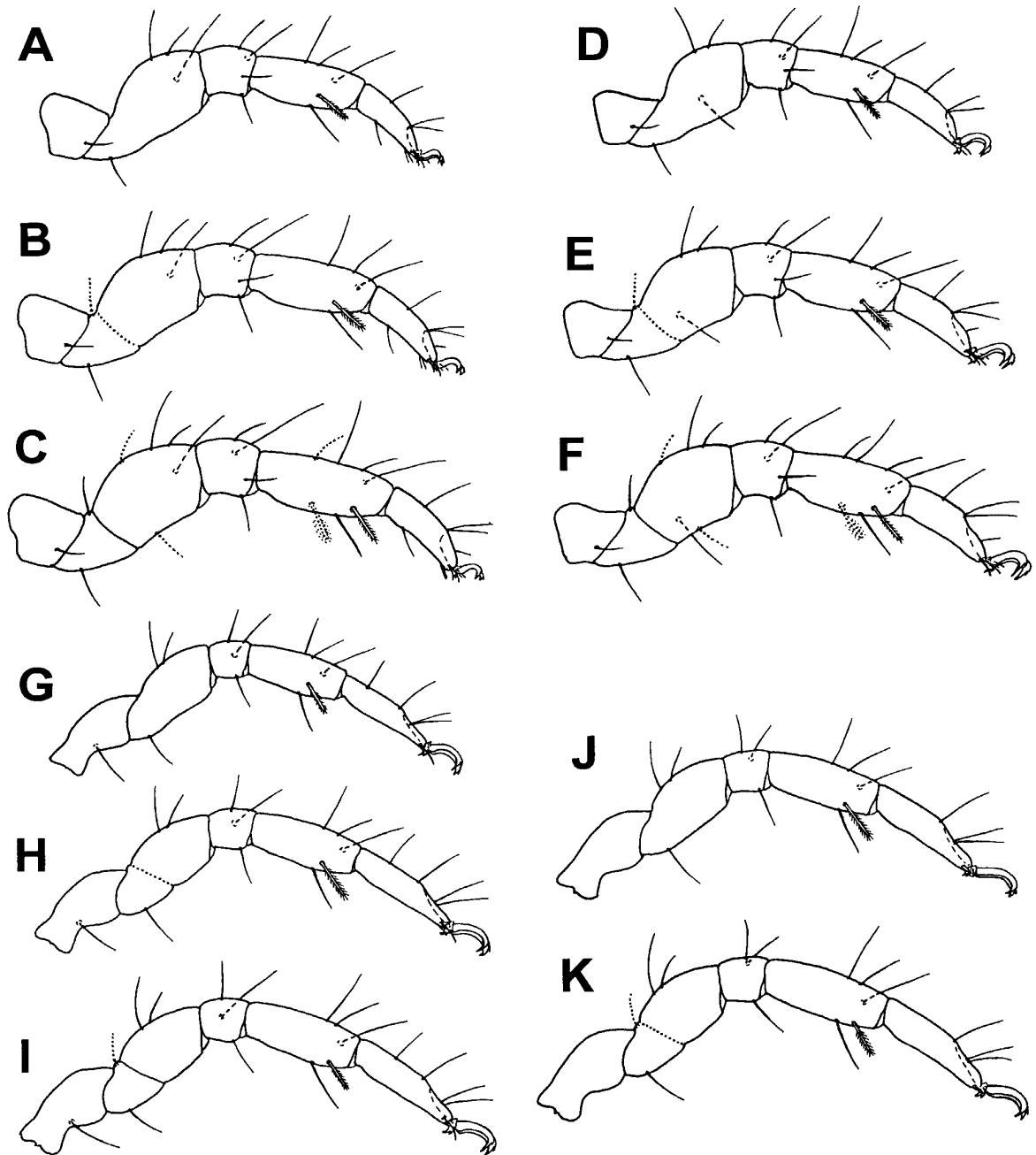


Fig. 6. Generalized legs of *Copidognathus*. A, leg I, medial, larva; B, leg I, medial, protonymph; C, leg I, medial, adult; D, leg II, medial, larva; E, leg II, medial, protonymph; F, leg II, medial, adult; G, leg III, medial, larva; H, leg III, medial, protonymph; I, leg III, medial, adult; J, leg IV, medial, protonymph; K, leg IV, medial, adult. (dotted lines indicate setae or divisions of segments that are new in this instar)

and many species have very prominent articular lamellae. In the protonymphs and larvae of these species the lamellae are present but small.

On the tarsi, the number but not the position of the dorsal and ventral setae is the same in all instars. Larvae of species with four dorsal setae on tarsus III often have the basalmost seta near the base of the tarsus, whereas in adults this seta may be immediately adjacent to the succeeding dorsal seta. Instead of doubled parambulacral setae, the small tarsi of the protonymphs and larvae often have singlets.

In general, the number of setae on genua I to IV is 4, 4, 3, 3, though species with fewer setae or more are known. The combination 4, 4, 3, 4 of species of the *bairdi* group (sensu Bartsch 1996) is present in both adults and protonymphs. Similarly, a reduced number of setae is expressed already in larvae and protonymphs (unpublished, in press).

Unaltered throughout the ontogeny are number and size of the dorsal idiosomal setae d-1 to d-6 and the gland pores, the number and arrangement of the setae on the rostrum, and, save few exceptions, their number on the gnathosomal base, and the number of setae on trochanters, genua and tarsi (apart from parambulacral setae).

### General Remarks

A pattern of development similar to that outlined above is found in the majority of the halacarid genera, though exceptions do exist. A reduction of the dorsal plates from the nymphal instar to the adults is expressed in *Metarhombognathus* (Newell 1947; Bartsch 1979) and in some few females of *Halacarus* (e.g., *H. peregrinus* Bartsch 1981a) and, otherwise unusual within halacarids, the adults of the majority of *Anomalohalacarus* have a longitudinally divided PD (Bartsch 1981b; Abé 1996). As described above, the number of setae on trochanters, genua and tarsi (parambulacral setae excluded) of *Copidognathus* remains unaltered throughout the life cycle, whereas in other halacarid genera, with a larger number of setae than in *Copidognathus*, more setae are added during development.

Compared to families also belonging to the suborder Prostigmata, e.g., the Bdellidae, Cunaxidae, Pezidae, Tenuipalpidae, and Tetranychidae, the number of setae on the dorsum, venter, and in general also on the legs of adult halacarids is reduced. During the postembryonic development, summarized for the Tetranychoida by Lindquist (1985), generally a larger number of additional setae than described for *Copidognathus* appear on the idiosoma and legs.

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